

Appendix M:

Structures Report

Report

Airport Road EA (King Street to Huntsmill Drive) - Structural Inspection and Assessment

Project 16-4360: Airport Road Improvements EA Between
King Street and Huntsmill Drive



Prepared for The Regional Municipality of Peel
by IBI Group
March 9, 2020

Document Control Page

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1 Introduction

The Region of Peel has retained IBI Group to conduct a Schedule 'C' Municipal Class Municipal Environmental Assessment (EA) study for Airport Road improvements between King Street and Huntsmill Drive within the Town of Caledon. The study corridor extends for 7.5 km from 100 m north of King Street to 300 m north of Huntsmill Drive. The study area includes nine existing culvert crossings consisting of six non-structural corrugated steel pipe (CSP) (C1, C4, C6, C7, C8 and C9), a non-structural concrete pipe (C2), a non-structural concrete box culvert (C5) and a structural concrete box culvert (C3). The study area and location of the existing culverts are illustrated in **Appendix A**.

The report summarizes the findings of the existing structural documentation, reviews of the existing structural condition and preliminary foundation recommendations by Terraprobe; and provides preliminary recommendations for the structural improvements including preliminary construction cost estimate and construction staging review.

2 Existing Conditions

Within the study area, there are eight non-structural culvert crossings and one structural concrete box culvert. A visual field inspection was performed on April 21, 2017. Photographs of the existing culverts to be replaced with structural culverts are presented in Appendix B.

2.1 Roadway Description

The existing Airport Road (Regional Road 7) is a north-south two lane arterial roadway (one for each direction) under the jurisdiction of the Regional Municipality of Peel. The roadway cross-section is comprised of the following lane widths and configurations:

Upper Huntsmill Culvert (C1) – STA 17+146.06:

- Two 3.5 m Traffic Lanes
- Two 3.0 m Unpaved Shoulders

Centerville Creek Culvert (C3) – STA 15+747:

- Two 3.75 m Traffic Lanes
- Two 3.0 m Multi-Use Pathways

2.2 Traffic Data

The existing posted speed limit along North/South section of Airport Road is 60 km/h at Upper Huntsmill Culvert (C1) and 50 km/h at Centerville Creek Culvert (C3). The average annual daily traffic (AADT) is 10,422 with truck volumes of 10 – 25 % of the total traffic as per 2016 Biennial Inspection Report.

2.3 Upper Huntsmill Culvert (C1) – STA 17+146.06

The existing culvert is located on Airport Road over Humber River Tributary, 0.08 km north of Huntsmill Drive. The culvert is a 900 mm corrugated steel plate pipe with an approximate total

length of 22 m. The culvert has no headwalls at the inlet and outlet and there are no available construction plans or maintenance data.

2.4 Centerville Creek Culvert (C3) – STA 15+747

The existing culvert is located on Airport Road over Centerville Creek, 0.24 km south of Old Church Road. The structure was built in 1960 and it is a cast-in-place rigid frame concrete box culvert with 4.3 m span and a vertical clearance of 0.76 – 1.1 m. The culvert has an overall length of the 17.7 m. Structural drawings of the culvert are not available and there is no record of rehabilitation for this structure.

The following is a summary of the findings based on the visual inspection and Biennial Bridge Inspection Report prepared by Engineering Management System Inc. dated July 25, 2016:

- Barrel is in fair condition with the following observed concrete defects; medium shrinkage cracks at the exterior surfaces; light scaling at the interior surfaces; and medium spalling at the front face surfaces.
- The existing Barrier/Railing system is in good condition with some corrosion.
- Masonry retaining walls at four quadrants are in good condition.
- Watercourse at both upstream and downstream exhibit medium aggradation.

The overall condition of existing structure is good but rehabilitation works is recommend to improve the durability of the structure and prevent further concrete deterioration. The rehabilitation works shall include concrete shallow repairs at the barrel and channel restoration at the upstream and downstream watercourse.

3 Hydrology

A preliminary hydraulic study was conducted to assess the hydraulic capacity of the existing culverts. The evaluation of the culverts was based on a 25-year design storm event in accordance with MTO HDDS WC-1 (adopted by the Region of Peel). The study determined that C1, C2, C3, C4, C7, C8, and C9 are hydraulically deficient and they do not meet the minimum 1.0 m freeboard requirement, with C2, C7, and C8 overtopping the roadway for the design flow. As a result of hydraulic deficiency, C1, C3, C4, C7, C8, and C9 will be replaced and upsized in the proposed condition. C6 will also be replaced due to poor physical condition. The study also recommends to replace the existing 900mm CSP culvert (C1) and the existing concrete box culvert (C3) with upsized open footing concrete structures.

Evaluation of the proposed and maintained culverts was based on a 25-year design storm event with the exception of C3 which was based on a 50-year design storm in accordance with MTO HDDS WC-1 for culvert spans exceeding 6.0 meters. In the proposed condition, all culverts are concrete with the exception of C2 which is CSP. All proposed culverts meet the hydraulic criteria with the exception of C3 and C7 which do not meet the required freeboard and are constrained by the Airport Road roadway profile. As a result, these culverts cannot be upsized further to meet hydraulic criteria without significantly impacting the road profile.

4 Replacement Alternatives

Based on the results of the hydraulics analysis, a replacement alternative has been assessed at each of the water crossings to accommodate the Airport Road improvements.

Terraprobe completed a preliminary foundation investigation and a geotechnical design report for the study area. The foundation design recommendations for proposed replacement of structures are summarized below.

Staging alternatives were reviewed and a preferred staging identified. Due to lack of viable detour options and high average annual daily traffic (AADT) on Airport Road, the replacement will be carried out in stages with two lanes of traffic maintained throughout construction.

Preliminary General Arrangement and Staging Drawings for the replacement of the structures are included in **Appendix C**, and preliminary cost estimate break-down for each structure is provided in **Appendix D**.

4.1 Upper Huntsmill Culvert (C1) – STA 17+146.06

4.1.1 Replacement Alternative

The existing 900mm CSP culvert will be removed and replaced with a precast concrete open footing culvert with 3.658 m span and 1.067 m rise. The structure will be constructed perpendicular to the roadway alignment with a total length of 24.1 m to accommodate road width of 11.0 m comprised of two 3.5 m traffic lanes and two 2.0 m paved shoulders. The maximum fill on culvert is 1555 mm and a new steel beam guiderail system (SBGR) will installed on both sides of the roadway.

4.1.2 Substructure Condition and Foundation Recommendation

In general, borehole logs indicate that the site is an asphalt pavement or topsoil, underlain by compact to dense fill and a very stiff clayey silt deposit. The precast structures will be supported on conventional spread footing and founded in the clayey silt till with factored ULS of 175 kPa and SLS of 150 kPa. Bottom of footing level will be approximately 3.4 m below existing ground surface. In accordance with Section 4.4.3.3 of CHBDC, and as per the site soil conditions, culvert at Sta. 17+145 is site Class E.

4.2 Centerville Creek Bridge (C3) – STA 15+747

4.2.1 Replacement Alternative

The existing concrete box culvert will be removed and replaced with a new structure which will be a precast open footing culvert with 12.192 m span and 1.372 m rise (1.829 m above invert) with a 150 mm reinforced concrete distribution slab. Retaining wall will be cast-in-place concrete or RSS wall. A box beam railing with concrete end walls will be provided on each side of the sidewalk. The structure will be constructed perpendicular to the roadway alignment with a total length of 18.4 m to accommodate the following features:

- Two 3.35 m Traffic Lanes
- Two 0.65 m Shoulders
- Two 1.2 m Concrete Buffer Zones
- Two 3.5 m Multi-Use Trails
- Two Steel Tube Railing on Sidewalks (TL-4)

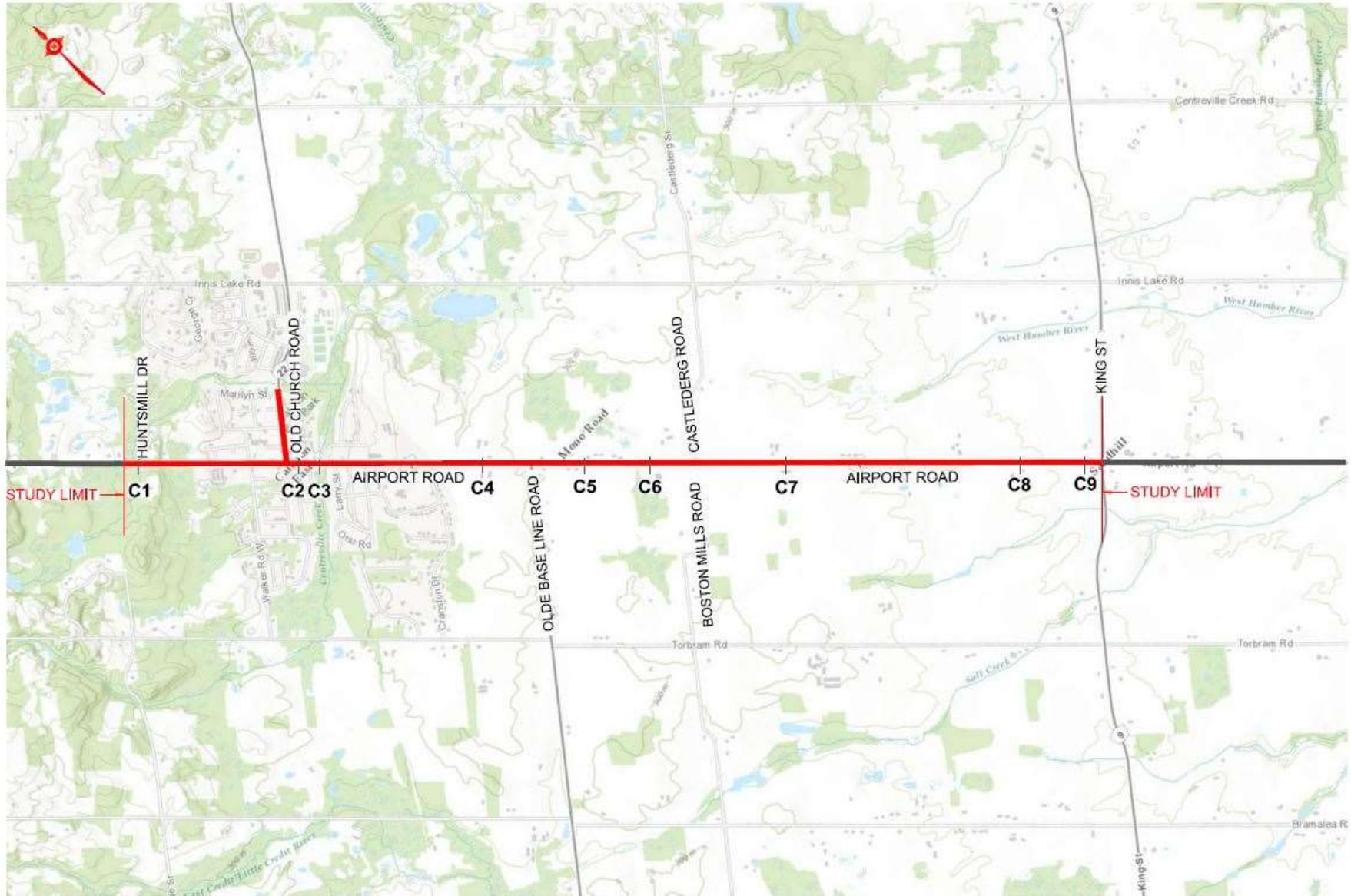
4.2.2 Substructure Condition and Foundation Recommendation

In general, borehole logs indicate that the site is an asphalt pavement or topsoil, underlain by weak/loose peat deposits. The total settlements are expected to exceed 25 mm if the structure is founded on this native soil and therefore a deep foundation is recommended. The geotechnical investigation and design report by Terraprobe dated August 16, 2019 recommends Chance helical piles to support the proposed structure with preliminary geotechnical reactions of 155 kN at ULS and 115 kN at SLS.

A preliminary structural assessment was carried out for the proposed structural loads and impractical footing size and number of piles were determined based on the provided geotechnical resistance values. Further geotechnical investigations are required within the footprint of the new structure to explore the depth of competent strata capable of providing sufficient design information for feasible deep foundations design.

In accordance with Section 4.4.3.3 of CHBDC and as per the site soil conditions, the culvert at Sta15+750 is classified as site class D.

Appendix A – Key Plan



IBI GROUP
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Client	THE REGION OF PEEL
Project	AIRPORT ROAD EA STUDY FROM KING STREET TO HUNTSMILL DRIVE
Drawing Title	KEYPLAN

Project No.	109535
Drawing No.	FIGURE-1

LEGEND

	STUDY AREA
	WATERCOURSE CROSSING

Appendix B – Site Photographs

C1 – Upper Huntsmill Culvert



Pic 001 – North Approach



Pic 002 – South Approach



Pic 003 – West Side



Pic 004 – East Side



Pic 005 – Culvert Inlet (West Side)



Pic 006 – Culvert Outlet (East Side) – Note Damaged CSP



Pic 007 – Upstream Watercourse



Pic 008 – CSP Culvert at Inlet Looking East

C3 – Centerville Creek Culvert



Pic 009 – North Approach



Pic 010 – South Approach



Pic 011 – West Elevation



Pic 012 – East Elevation



Pic 013 – Culvert Inlet (West Side) – Note Shrinkage Cracks at the Exterior Surfaces (End)



Pic 014 – Culvert Outlet (East Side)



Pic 015 – Concrete Scaling at the Culvert Outlet – Exterior Surfaces (End)



Pic 016 – Scaling at The Interior Surfaces (Soffit) – East End



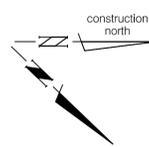
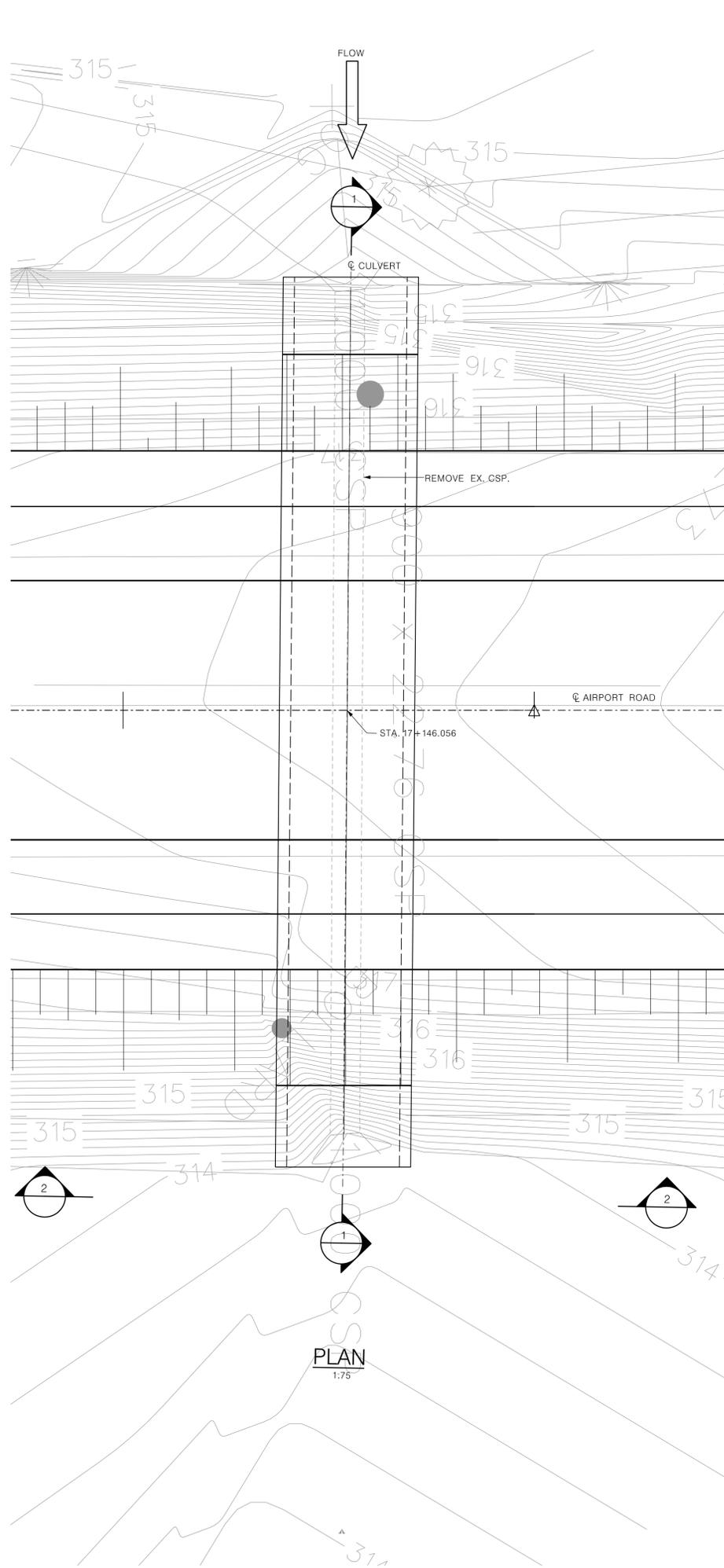
Pic 017 – Interior Surfaces (Soffit) – Looking West



Pic 018 – Downstream Watercourse

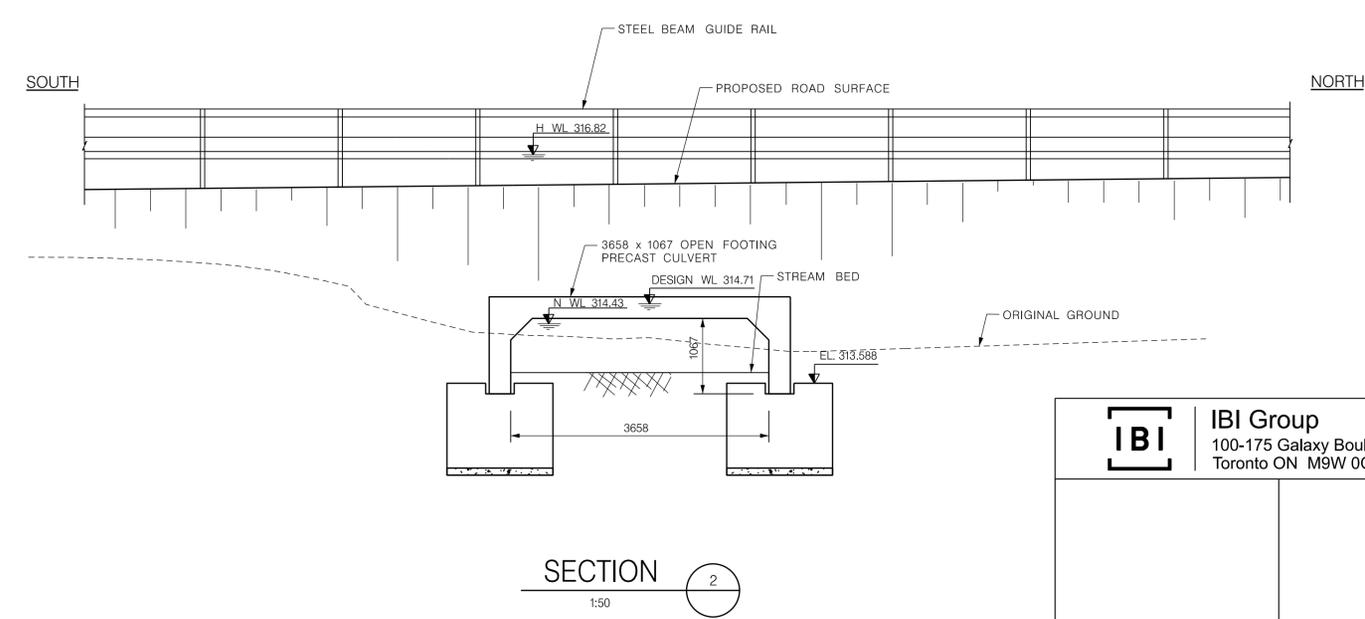
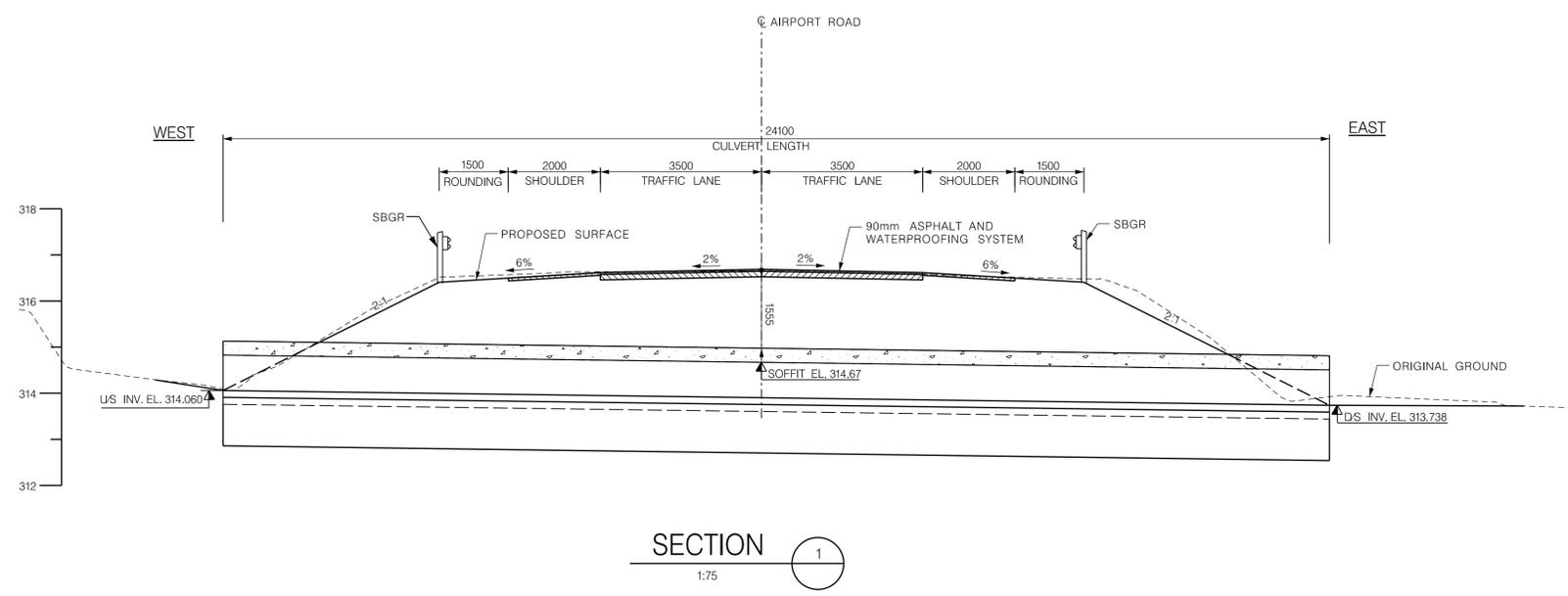
Appendix C – Preliminary General Arrangement and Construction Staging Drawings

J:\109535_Airport_Rd_EA#5.9 Drawings#59br\idg#01-GA_STA_17+146.06 Culvert.dgn
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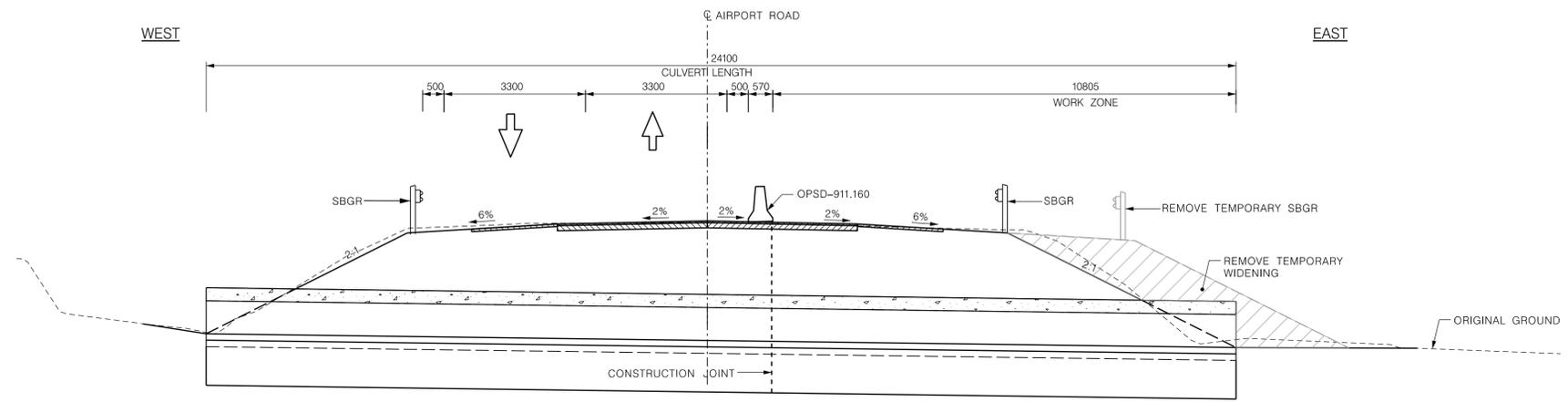
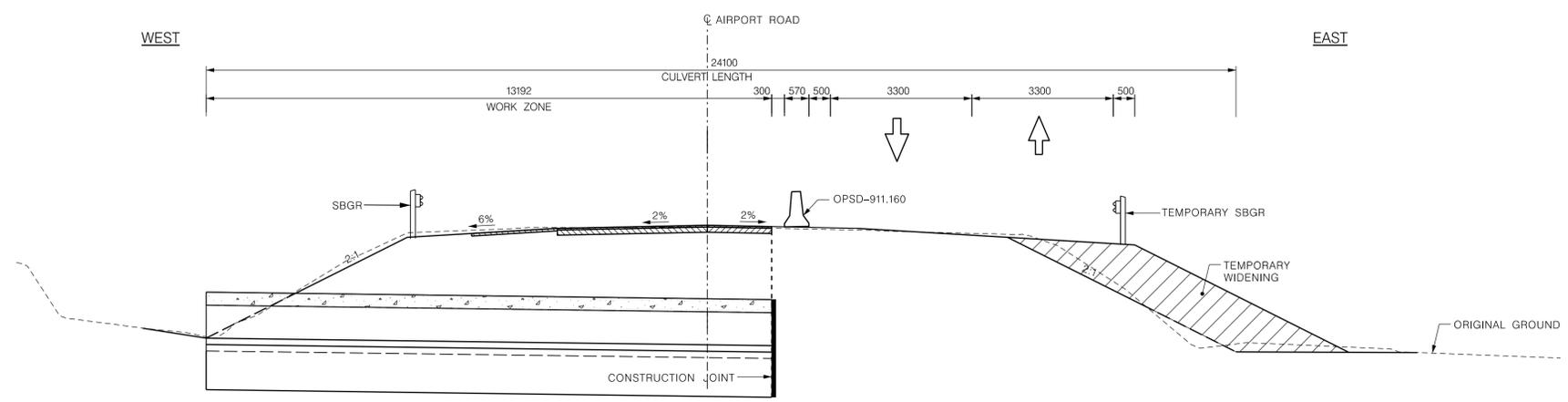
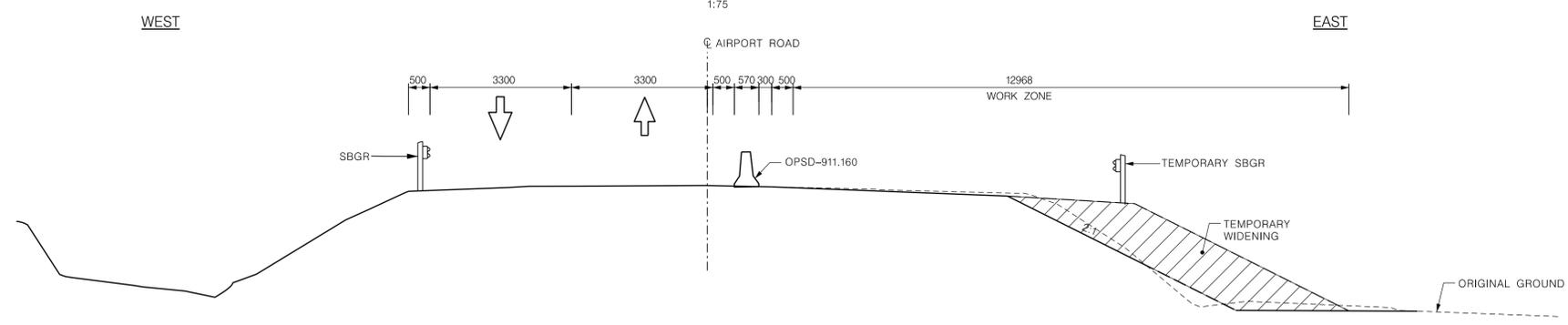
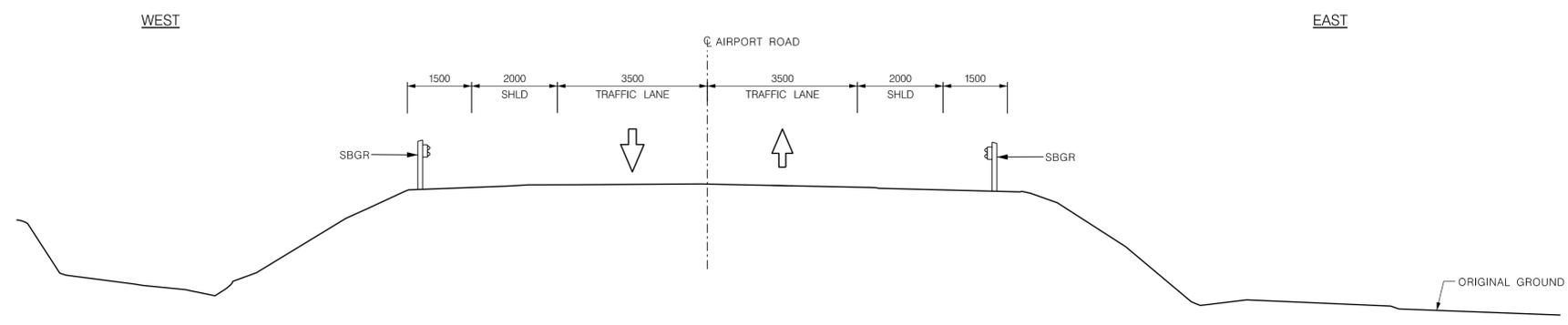


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Designed by	Approved by	
 Region of Peel Working for you		
AIRPORT ROAD CULVERT AT 17+146.056 (C1) PRELIMINARY GENERAL ARRANGEMENT UPPER HUNSMILL CULVERT		
CAD Area	Area	Project No.
Checked by R.W.	Drawn by J.S.	
Date OCT. 2019	Sheet 1 of 4	Plan No.

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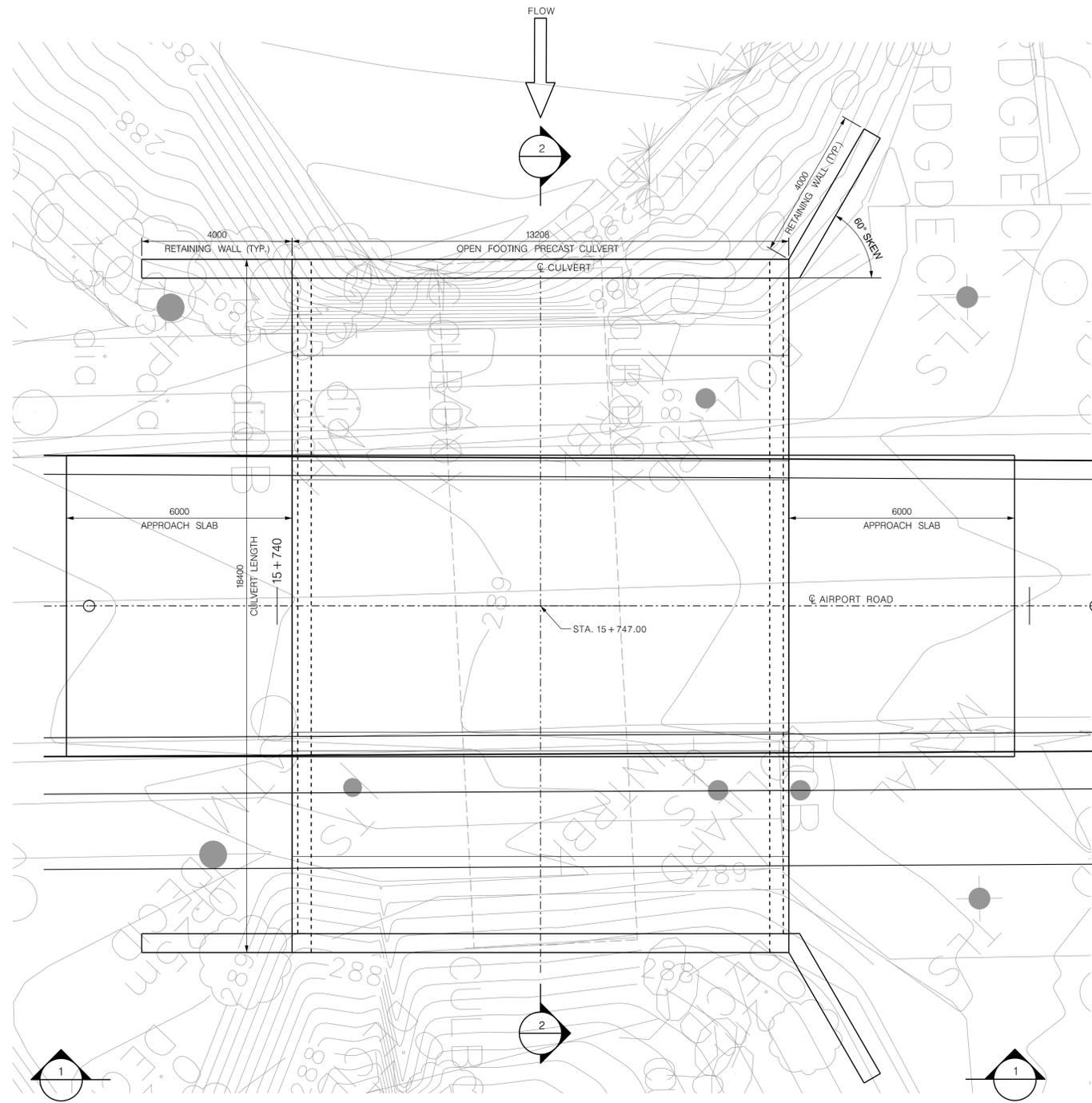
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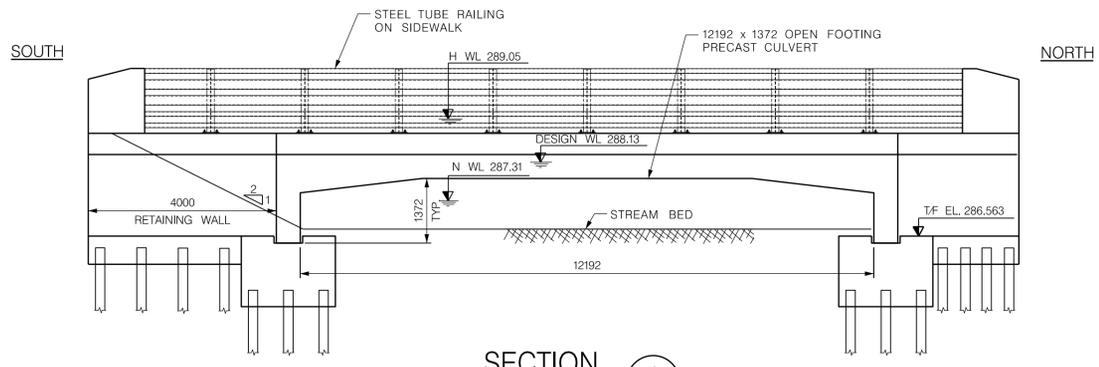
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 Region of Peel <i>Working for you</i>			
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		Plan No.	

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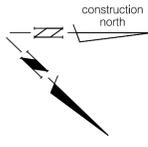
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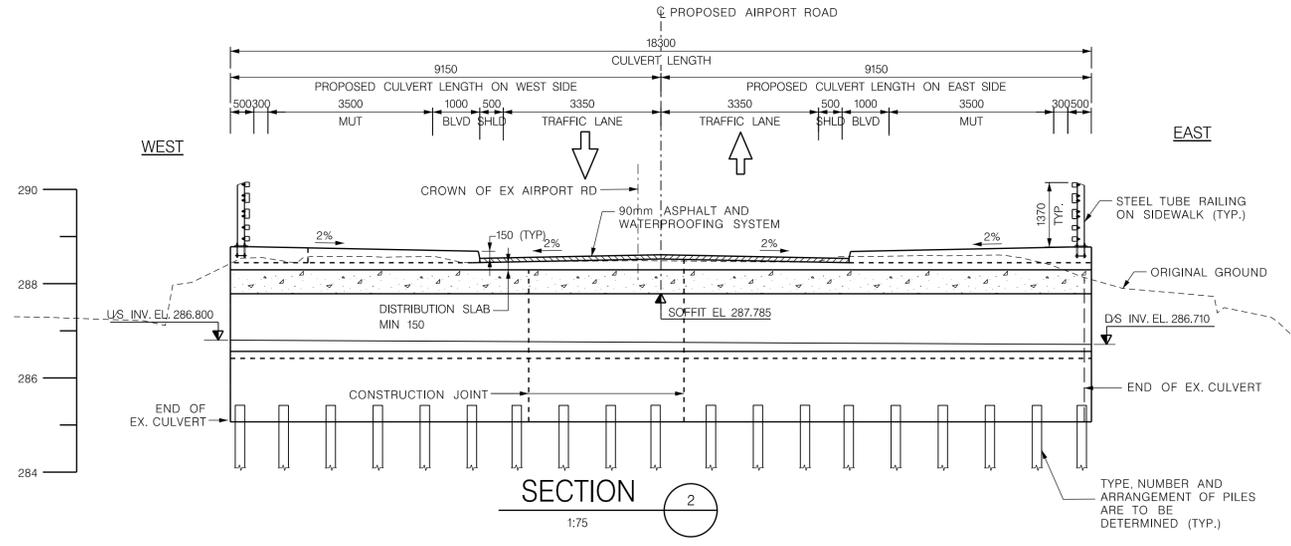


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AIRPORT ROAD
CULVERT AT STA 15+747 (C3)
PRELIMINARY GENERAL ARRANGEMENT
CENTERVILLE CREEK BRIDGE

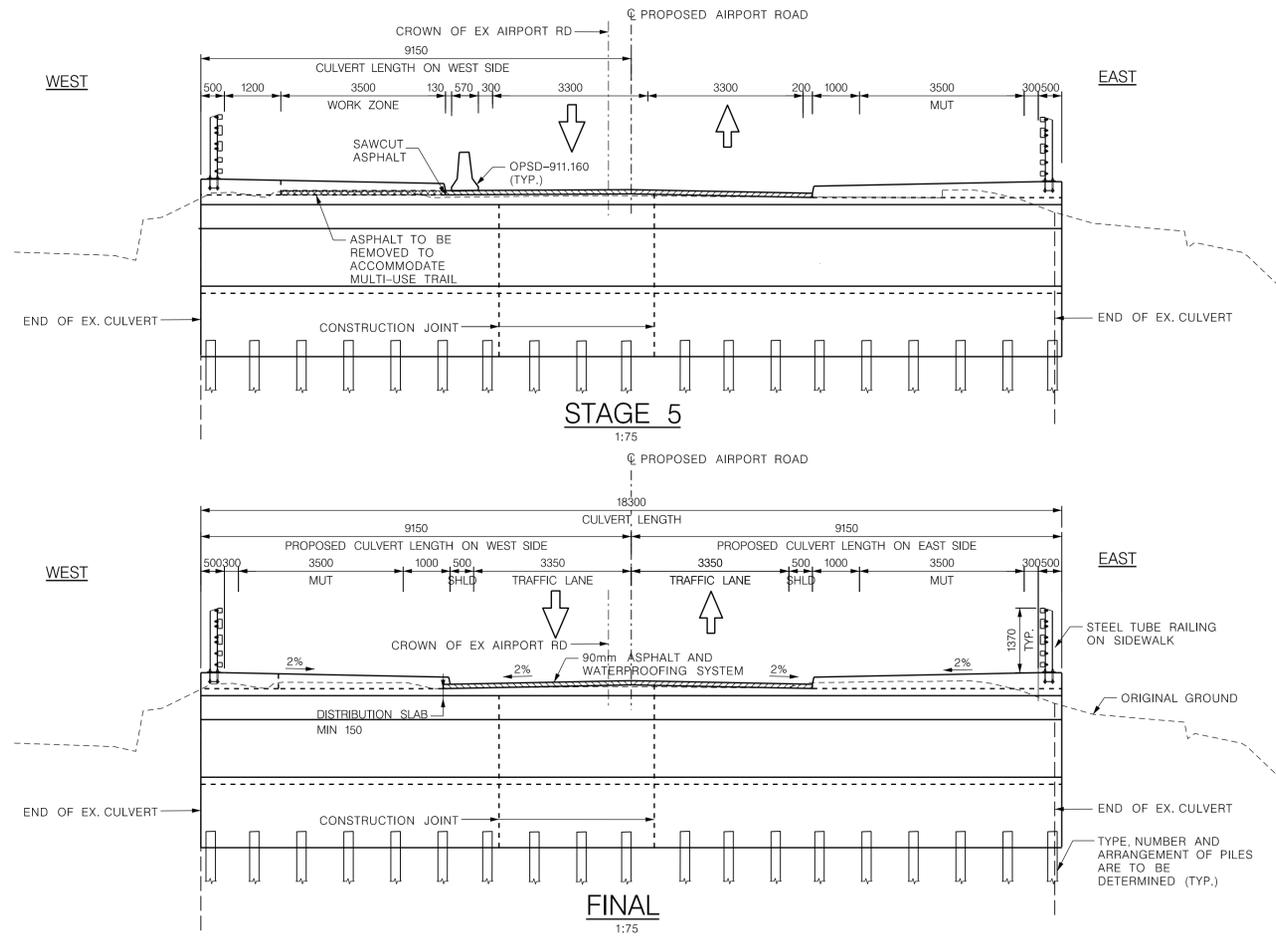
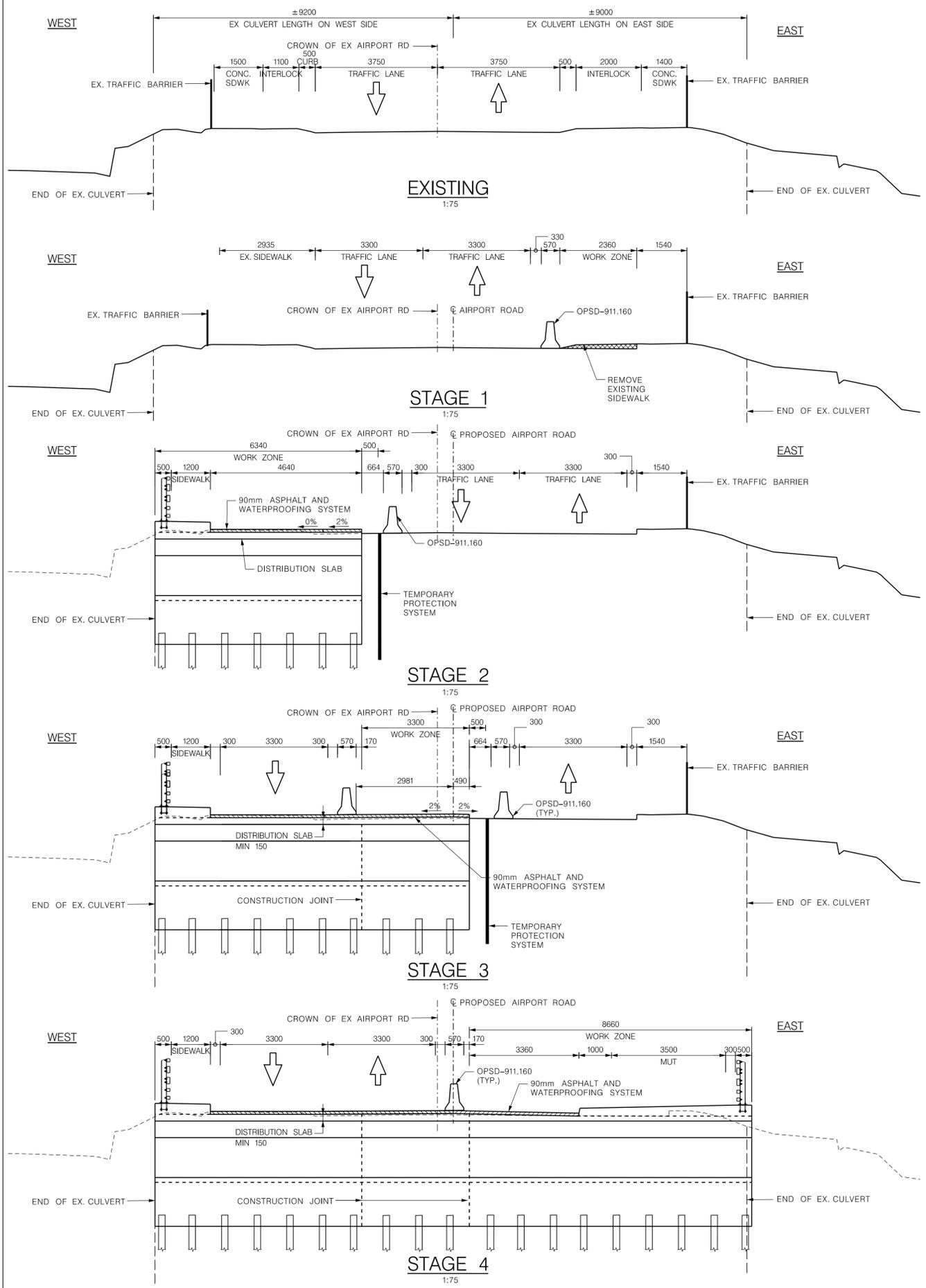
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Date OCT. 2019	Sheet 3 of 4	Plan No.

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NOTE: STAGE 2 & 5 NO SIDEWALK WEST SIDE.
 STAGE 1 & 4 NO SIDEWALK EAST SIDE.

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AIRPORT ROAD CULVERT AT STA 15+747 (C3) CONSTRUCTION STAGING CENTERVILLE CREEK BRIDGE		
CAD Area	Area	Project No.
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Date OCT. 2019	Sheet 4 of 4	Plan No.

Appendix D – Preliminary Cost Estimate

Preliminary Cost Estimate – Upper Huntsmill Culvert (C1) at STA 17+146.06
Replacement with Precast Open Footing Culvert (3.658 m X1.067 m)

Item No.	Spec. Code	Item Description	Unit	Quantity	Unit Price	Total
1	OPSS.MUNI 510	Removal of Existing Structure	LS	1.0	\$5,000.00	\$5,000.00
2	OPSS.MUNI 539	Protection System	LS	1.0	\$30,000.00	\$30,000.00
3	OPSS 902	Earth Excavation for Structure	m ³	711.0	\$30.00	\$21,328.50
4	OPSS 902	Dewatering Structure Excavations/Cofferdam	LS	1.0	\$50,000.00	\$50,000.00
5	OPSS 902	Granular Backfill to Structure	m ³	578.4	\$30.00	\$17,352.00
6	OPSS.MUNI 904	Concrete in Footing	m ³	108.5	\$600.00	\$65,070.00
7	OPSS.MUNI 904	Precast Open Footing Culvert Fabrication/Delivery/Installation	LS/m ³	51.6	\$2,000.00	\$103,111.08
8	OPSS.MUNI 905	Reinforcing Steel Bar	LS/t	12.8	\$2,500.00	\$31,924.97

Subtotal	\$323,786.55
Contingency (15%)	\$48,567.98
Grand Total	\$372,354.53

**Preliminary Cost Estimate – Centerville Creek Bridge (C3) at STA 15+747
Replacement with Precast Open Footing Culvert (12.192 m X1.372 m)**

Item No.	Spec. Code	Item Description	Unit	Quantity	Unit Price	Total
1	OPSS.MUNI 510	Removal of Existing Structure	LS	1.0	\$50,000.00	\$50,000.00
2	OPSS.MUNI 539	Protection System	LS	1.0	\$50,000.00	\$50,000.00
3	OPSS 902	Earth Excavation for Structure	m ³	732.0	\$30.00	\$21,960.77
4	OPSS 902	Dewatering Structure Excavations (including cofferdam)	LS	1.0	\$150,000.00	\$150,000.00
5	OPSS 902	Granular Backfill to Structure	m ³	441.6	\$30.00	\$13,248.00
6	OPSS.MUNI 904	Concrete in Footing	m ³	110.4	\$600.00	\$66,240.00
7	OPSS.MUNI 904	Concrete in Retaining Wall	m ³	64.0	\$1,000.00	\$64,000.00
8	OPSS.MUNI 904	Precast Open Footing Culvert Fabrication/Delivery/Installation	LS/m ³	147.8	\$2,000.00	\$295,640.34
9	OPSS.MUNI 904	Concrete in Distribution Slab and Sidewalk	m ³	136.8	\$1,000.00	\$136,792.61
10	OPSS.MUNI 904	Concrete in Approach Slab	m ³	25.0	\$600.00	\$14,983.20
11	OPSS.MUNI 904	Concrete in End Wall	m ³	4.8	\$1,750.00	\$8,416.80
12	OPSS.MUNI 905	Reinforcing Steel Bar	LS/t	33.6	\$2,500.00	\$84,041.15
13	OPSS.MUNI 905	Reinforcing Stainless Steel Bar	LS/t	1.1	\$12,000.00	\$13,591.93
14	OPSS.MUNI 908	Metal Traffic Barrier	m	42.4	\$500.00	\$21,208.00
15	OPSS.MUNI 914	Bridge Deck Waterproofing	LS/m ²	115.3	\$40.00	\$4,610.56
16	OPSS.MUNI 914	Membrane Reinforcement	m	16.0	\$30.00	\$480.00
17	OPSS.MUNI 914	Form and Fill Grooves	m	16.0	\$65.00	\$1,040.00

Subtotal	\$996,253.37
Contingency (15%)	\$149,438.01
Grand Total	\$1,145,691.38

The following cost estimate for piles is based on the provided geotechnical investigation and design report by Terraprobe dated August 16, 2019. Further geotechnical investigations are required for sufficient design information and feasible deep foundations design:

Item Description		Unit	Quantity	Unit Price	Total
Helical Piles	a) Mobilization	LS	1.0	\$20,000.00	\$20,000.00
	b) Lead Sections	ea	128.0	\$650.00	\$83,200.00
	c) Installation	m	1280.0	\$175.00	\$224,000.00
	d) Load Test	LS	1.0	\$12,000.00	\$12,000.00

Subtotal	\$339,200.00
Contingency (15%)	\$50,880.00
Total	\$390,080.00